REMARKS

Initially, Applicant's undersigned attorney expresses appreciation to the Examiner for the courtesy extended during telephone interviews on December 1, 2005 and December 8, 2005.

In the Office Action mailed December 15, 2005, the Examiner rejected Claims 1-6, 11-15 and 18-21 under 35 U.S.C. §103(a), based upon the newly-cited Japanese Reference No. 95090 of *Sato, et al.* Further, claims 1-14 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,267,221 to *Miller, et al.*, Claims 15-17 were rejected under 35 U.S.C. §103(a) as being unpatentable over *Miller, et al.* in view of U.S. Patent No. 5,920,972 to *Palczewska*, and Claims 18-29 were rejected as being unpatentable under *Miller, et al.* in view of U.S. Patent No. 6,546,803 to *Ptchelintsev et al.* Applicant submits that all pending claims are allowable over the art.

In particular, Independent Claims 1 and 22 are each directed to an ultrasound probe that includes a support member comprising an acoustic dampening material, a signal cable having a plurality of electrically conductive members/wires extending continuously along the length of said cable, and an ultrasound transducer array having a plurality of transducer elements supportably mounted to a first side of the acoustic dampening support member. Of importance:

> (i) a distal end portion of each of the plurality of electrically conductive members/wires of the signal cable is embedded within and continuously extends into and through the acoustic dampening support member to a first side from a second side thereof, and
>
> (ii) a flexible primary portion <u>of the same signal cable</u> extends proximally away from the second side of the acoustic dampening support member with said plurality of electrically conductive members/wires being electrically separated in the flexible primary portion by an electrically non-conductive material.

Of further importance, a plurality of transducer elements comprising the ultrasound transducer array are <u>electrically, directly and fixedly interconnected to the distal end of corresponding different ones</u> of the plurality of electrically conductive members/wires at the first side of the support member. To emphasize, each of the electrically conductive members/wires of the signal cable comprising the ultrasound probe of Claims 1 and 22 extends:

> (i) <u>continuously</u> from a proximal end of the flexible primary portion of the signal cable,
>
> (ii) <u>continuously</u> into the second side of the acoustic dampening support member, and

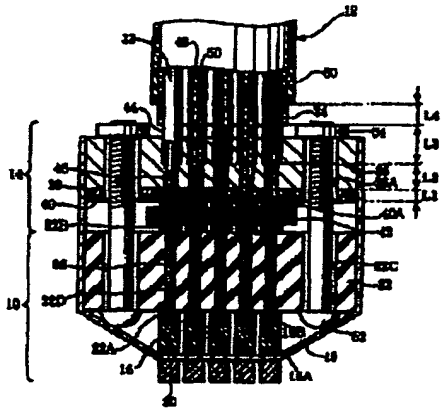
(iii) continuously through the acoustic dampening support member to a distal end at the first side of the support member that is electrically, directly and fixedly interconnected to a corresponding ultrasound transducer array element.

The cited art fails to disclose or render obvious the noted features of the ultrasound probe of Claims 1 and 22.

In particular, *Sato, et al.* fails to disclose an ultrasound probe comprising a signal cable having a plurality of electrically conductive members that extend through an acoustic dampening support member, much less an ultrasound probe in which the plurality of electrically conductive members are electrically, directly and fixedly interconnect at a distal end to corresponding different ones of a plurality of transducer elements comprising an ultrasound transducer array. In this regard, and for the Examiner's convenience, Applicant has attached hereto in **Appendix A** a translation of the *Sato, et al.* reference that was obtained from the Japanese Patent Office website.

Of initial note, and with reference to FIG. **2** of *Sato, et al.* reproduced below, it is respectfully pointed out that in *Sato, et al.* the vibrator unit **10** is not directly connected to the conductor cable **12**. Rather, a portion of the connection unit **14** is interposed therebetween and thereby renders *Sato, et al.* clearly distinguishable from the present invention.

More particularly, and with reference to FIG. **2** of *Sato, et al.* reproduced below, the inner conductor **50** of each cable **32** of conductor cable **12** terminates at the face of electrode substrate **40** and is offset from the vibrator unit **10** by electrode pad **40A**, anisotropy conductive member **42** and electrode pad **40B**. In this regard, it is critical to understand that electrode pads **40A** and **40B** are not part of the vibrator unit **10**. Rather, the vibrator unit **10** comprises piezoelectric devices **16** having an electrode layer **16A** located on one side thereof and electrode layers **16B** and **22A** located on the other side thereof.



In short, in the illustrated embodiment of *Sato, et al.*, four intervening, electrically conductive elements are interposed between the end of each inner conductor **50** of conductor cable **12** and the ultrasound transducer elements of vibrator unit **10** (i.e., electrode pad **40A**, anisotropy conductive member **42**, electrode pad **22B** and leader line **56**). In the latter regard, it should be understood that leader lines **56** extend through the backing **22** of the vibrator unit **10**, as opposed to the inner conductor **50** of each cable **32** comprising conductor cable **12**. In fact, connector unit **14** is specifically manufactured to define standing ways **36** positionable about inner conductors **50**, such standing ways **36** being offset from backing **22**. The *Sato, et al.* arrangement is clearly different then the ultrasound probe of independent Claims 1 and 22 and represents yet another example of the prior art that Applicant has made an improvement over.

Indeed, while *Sato, et al.* goes to significant effort to provide a connection unit **14** having intervening electrode layer **40A**, anisotropy conductive member **42** and electrode layer **22B**, Applicant's invention does not include such componentry, and further does not require the inclusion of separate leader line **56** elements. Rather, in Applicant's claimed ultrasound probe, electrically conductive members/wires of a signal cable extend continuously from a proximal end of a proximal portion of a signal cable, continuously into a second side of an acoustic dampening support member, and continuously through the acoustic dampening support member to distal ends that are each electrically, directly and fixedly interconnected to a corresponding ultrasound transducer array element.

The cited reference of *Miller, et al.* also fails to disclose or suggest Applicant's inventive ultrasound probe, including inter alia, a signal cable comprising a plurality of electrically conductive

members/wires that extend continuously from a proximal end of the flexible primary portion of the signal cable, continuously into the second side of the acoustic dampening support member, and continuously through the acoustic dampening support member to a distal end at the first side of the support member that is electrically, directly and fixedly interconnected to a corresponding ultrasound transducer array element. In this regard, in the Summary section, *Miller, et al.* states that:

> [T]his invention provides a transducer assembly which includes an acoustic transducer array, an electric circuit element and a backing for interfacing the array with the circuit element. . . . The acoustic transducer array may be a one-dimensional or two-dimensional array of transducer elements, each of which elements has a first acoustic impedance, a rear face and an electrical contact at its rear face. The circuit element has a contact for each transducer element. The backing consists of a block . . . . At least one electrical conductor for each transducer element extends through the block between the top and bottom faces thereof. . . . [T]he backing includes a means for effecting electrical contact between the circuit contact for each transducer element and the corresponding at least one electrical conductor. (Emphasis added.) *Col. 2, lines 44-45, lines 51-57, Col. 3, lines 3-5, lines 13-16.*

Clearly, such language contemplates a transducer assembly in which separate circuit elements contact separate backing electrical conductors. via a backing means for effecting electrical contact, and the backing electrical conductors contact transducer elements. As to the "backing means for effecting electrical contact" the Summary states:

> [A] pattern of electrical contacts substantially matching the circuit element contact pattern may be formed on the bottom face of the backing. It is also possible for each electrical conductor to extend beyond the bottom face of the block and to be physically and electrically connected to a corresponding electric circuit contact. (Emphasis added.) *Col. 4, lines 24-30.*

Of note, the establishment of physical contact between separate elements (i.e. circuit element contacts and backing electrical conductors) is taught by *Miller, et al.*, as opposed to the provision of continuously extending electrically conductive members/wires of a signal cable, as per Applicant's Claims 1 and 22. This distinction is further evidenced by the embodiments described in the Detailed Description of *Miller, et al.*, which states with reference to FIG. 4 reproduced below:

> FIGS. 2 and 3 show embodiments of the invention for two-dimensional and one dimensional acoustic transducer arrays, respectively. The transducer array **25.1** shown in FIG. 3 is

substantially the same as the assembly shown in FIG. 1 with a transducer array **15.1** and a printed circuit board.... FIGS. **4-9** show small portions of illustrative embodiments of transducer assemblies **25** suitable for use as the assemblies **25.1** or the assembly **25.2** in FIGS. **3** and **2**, respectively. Referring first to FIG. **4**, it is seen that backing **27** is formed of a block **37** of an acoustic energy attenuating material, which block has electrical conductors **39** extending from top surface **31** to bottom surface **33**.... For the embodiment shown in FIG. **4**, it is assumed that both top surface **31** and bottom surface **33** have been initially metalized with a conductive material and that the metal is then etched away... to leave contacts **35** on top face **31** in physical and electrical contact with conductors **39** projecting from block **37**, and to leave electrical contacts **41** on the bottom surface **33** which are in physical and electrical contact with conductors **39** at surface **33**.... The transducer array **15**, circuit board **19** and backing **27** are then assembled... with contacts **41** in physical and electrical contact with contacts **22** on board **19**. An epoxy or other suitable adhesive may be applied to either one or both surfaces to be brought together,... the layer of adhesive... between adjacent contacts **22** and **41** being sufficiently thin... so as not to provide significant electrical or acoustic impedance at these junctions. (Emphasis added.) *Col. 4, lines 59-64 through Col. 5, lines 48-49, lines 52-55, lines 60-65.*

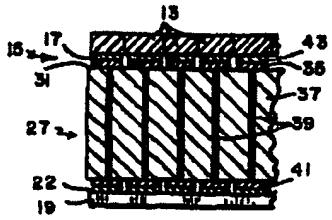


FIG. 4

In short, in the noted embodiments, electrical contact between circuit board **19** and transducer array **15** is achieved by physical contact between separately provided contacts **22** on board **19** and contacts **41** on the bottom surface **33** of block **37** (e.g. across a thin adhesive layer); physical contact between

separately provided conductors 39 of block 37 and contacts 41 thereof; and physical contact between conductors 39 and transducer array 15.

In relation to the only other embodiment described, *Miller, et al.* states:

> FIG. 5 also illustrates another alternative in the construction of this invention in that contacts 22 and 41 have been replaced by extending conductors 39 beyond the end of block 37, and by passing these extended conductors through plated-through holes 45 in circuit board 19 and securing the extended leads in the plated-through holes by standard techniques known in the art, such as soldering. (Emphasis added.) *Col. 8, lines 36-43.*

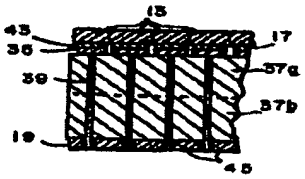


FIG. 5

In this embodiment, electrical contact between circuit board 19 and transducer elements 13 (i.e. transducer array 15) is achieved by physical contact between separately provided plated-through holes 45 in circuit board 19 and conductors 39 of block 37 that separately pass through and secure within the plated-through holes 45 of circuit board 19, e.g. by soldering.

As may be appreciated, the above-noted aspects of the described embodiments of *Miller, et al.* correspond with the "backing means for effecting electrical contact" contemplated by the Summary section thereof. In each case, a physical interface between a separately provided circuit element contact and backing electrical conductor is utilized, in contradistinction to the ultrasound probes of Claims 1 and 22. This fact is in no way obviated by language in *Miller, et al.* that states that:

> The circuit element may be a printed circuit board, flexible cable, semiconductor element . . . or other element to which electrical contact may be made. . . . The circuit element has a contact for each transducer element. *Col. 2, lines 47-57.*

While the noted language of *Miller, et al.* contemplates that the circuit element may be a flexible cable, it is also consistent with the above-referenced teachings that require the inclusion of separate backing electrical conductors and circuit element contacts.

Similarly, such requirement is consistent with the language of *Miller, et al.* that states that:

> The transducer array **25.1** shown in FIG. **3** is substantially the same as the assembly shown in FIG. **1** with a transducer array **15.1** and a printed circuit board, strip, cable, semiconductor element . . . or the like **19.1** (hereinafter "circuit element") having leads **11** formed thereon. Where contact is made directly to a semiconductor element, and in other selected applications, leads **11** may not be employed. The difference is in backing **27.1** between the transducer array and the circuit board which has leads (not shown) embedded therein. Contacts **29.1** are provided on circuit element traces **11** to facilitate connection. *Col. 4, line 61 - Col. 5, line 4.*

Such language corresponds with the two alternate "backing means for effecting electrical contact" discussed above, each of which requires separately provided, physical interconnection interfaces between the contacts **22**/through holes **45** of circuit element **19** and block conductors **39**. Indeed, the noted distinguishing feature and required element of *Miller, et al.* is even stipulated in the independent claims of *Miller, et al.*

Again, such separately provided, physical interconnection is distinguishable from the ultrasound probes of Claims 1 and 22, which utilize a signal cable having a plurality of electrical conductors/wires that extend continuously from a proximal end of the flexible primary portion of the signal cable, continuously into the second side of the acoustic dampening support member, and continuously through the acoustic dampening support member to distal ends at the first side of the support member that are electrically, directly and fixedly interconnected to corresponding ultrasound transducer array elements.

For the record, Applicant notes that it is clear that the prior art must teach or otherwise motivate a combination of prior art references. For example, in the CAFC decision of *In re Anita Dembiczak and Vincent Zinbarg, 175 F.3d 994. U.S.P.Q.2D (BNA) 1614 (Fed. Cir. 1999)* the Court stated:

> Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the

> requirement for a showing of the teaching or motivation to combine prior art references. See, e.g., *C.R. Bard, Inc. v. M3 Sys., Inc., 157 F.3d 1340, 1352, 48 U.S.P.Q.2D (BNA) 1225, 1232 (Fed. Cir. 1998)* (describing "teaching or suggestion or motivation [to combine]" as an "essential evidentiary component of an obviousness holding"); *In re Rouffet, 149 F.3d 1350, 1359, 47 U.S.P.Q.2D (BNA) 1453, 1459 (Fed. Cir. 1998)* ("the Board must identify specifically...the reasons one of ordinary skill in the art would have been motivated to select the references and combine them"); *In re Fritch, 972 F.2d 1260, 1265, 23 U.S.P.Q.2D (BNA) 1780, 1783 (Fed. Cir. 1992)* (examiner can satisfy burden of obviousness in light of combination "only by showing some objective teaching [leading to the combination]"); *In re Fine, 837 F.2d 1071, 1075, 5 U.S.P.Q.2D (BNA) 1596, 1600 (Fed. Cir. 1988)* (evidence of teaching or suggestion "essential" to avoid hindsight); *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 297, 227 U.S.P.Q. (BNA) 657, 667 (Fed. Cir 1985)* (district court's conclusion of obviousness was error when it "did not elucidate any factual teachings, suggestions or incentives from this prior art that showed the propriety of combination"). See also *Graham, 383 U.S. at 18, 148 U.S.P.Q. (BNA) at 467* ("strict observance" of factual predicates to obviousness conclusion required). Combining prior art references without evidence of such a suggestion, teaching, or motivation simply takes the inventor's disclosure as a blueprint for piecing together the prior art to defeat patentability--the essence of hindsight. See, e.g., *Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 1138, 227 U.S.P.Q. (BNA) 543, 547 (Fed. Cir. 1985)* ("The invention must be viewed not with the blueprint drawn by the inventor, but in the state of the art that existed at the time."). In this case the Board fell into the hindsight trap.

Applicant submits that in the present case the Examiner's reliance on either *Sato, et al.* or *Miller, et al.* to reject Claims 1 and/or 22 is the result of inappropriate hindsight analysis and, for the various reasons noted above, Applicant respectfully requests withdrawal of claim rejections based thereupon.

In view of the foregoing, Applicant submits that independent Claims 1 and 22 are allowable over the art. Applicant further submits that dependent Claims 2-21 and 23-29 are allowable for the same reasons noted above, and further since such claims present further inventive combinations not disclosed or rendered obvious by the prior art.

Based upon the foregoing, Applicant believes that all pending claims are in condition for allowance and such disposition is respectfully requested. In the event that a telephone conversation would further prosecution and/or expedite allowance, the Examiner is invited to contact the undersigned.

Respectfully submitted,

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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the connection structure of a cable about an ultrasound probe and its manufacture approach.
[0002]
[Description of the Prior Art] 2-dimensional array vibrator (2D vibrator) consists of two or more oscillating components by which the two-dimensional array was carried out. Such a 2-dimensional array trembler is used, when scanning a 2-dimensional ultrasonic beam and incorporating three-dimensions echo data. As other array vibrator, 1D array vibrator, 1.5D array vibrator, etc. are known.
[0003] In the conventional general manufacture approach, when it interconnects the leader line group pulled out from a 2-dimensional array trembler, and the cable group which constitutes a multi-conductor cable, the flexible circuit board (FPC) under which the leader line group crowded in and was laid is used, and the inner conductor of each cable by which terminal treatment was carried out to each electrode on the flexible circuit board is soldered directly. Or one connector on the flexible circuit board and the connector of another side where the inner conductor of each cable was soldered are connected.
[0004]
[Problem(s) to be Solved by the Invention] Therefore, in the former, it surely becomes easy to produce an electric cross talk at a flexible time on the street or a cable splicing point, and there is a problem that this reduces image quality. Moreover, since it is generally super-thin, prudent handling is called for, and each cable requires an effort great for the terminal treatment (soldering) of hundreds of cables especially. Consequently, there is a problem that a manufacturing cost increases. Furthermore, in such a production process, it will be necessary to perform the check of a misdelivery-of-mail line etc. Moreover, the structure of an ultrasound probe becomes complicated for the existence of such a connection part and the flexible circuit board, and it becomes the hindrance of the miniaturization.
[0005] Especially the above-mentioned problem becomes more remarkable, as an element number increases. Of course, in connection with increase of an element number, the above-mentioned problem is remarkable also about array vibrator other than 2D array vibrator.
[0006] This invention is made in view of the above-mentioned conventional technical problem, and the purpose enables it to perform electrical installation of an array trembler and a cable group simple and certainly.
[0007] Other purposes of this invention are to reduce the manufacturing cost of an ultrasound probe.
[0008] Other purposes of this invention are shown in attaining the miniaturization of an ultrasound probe.
[0009] Other purposes of this invention are to raise the operational reliability of an ultrasound probe.
[0010]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, (1) This invention Are the member which carries out alignment maintenance of the cable group into which the edge showed and was processed at the shape of an array, and while interconnecting electrically, the gland of each

cable The part I material which forms the 1st terminal array as an end-face array of the inner conductor of each cable, The part II material which is a member which carries out alignment maintenance of the leader line group pulled out from two or more piezoelectric devices at the shape of an array, and forms the 2nd terminal array as an end-face array of each leader line, It is characterized by including the connecting means connected mutually electrically, positioning said 1st terminal array and said 2nd terminal array.

[0011] According to the above-mentioned configuration, alignment maintenance of each cable (desirably coaxial cable) is carried out by the part I material, and the gland of each cable is mutually connected electrically in that case. Moreover, the 1st terminal array corresponding to the end-face array of the inner conductor of each cable is formed of such alignment maintenance of each cable. Here, although each terminal which constitutes the 1st terminal array may be the ground end face of the inner conductor of each cable itself, it may attach an electrode pad in such an end face.

[0012] On the other hand, alignment maintenance of each leader line is carried out by the part II material, and the 2nd terminal array corresponding to the end-face array of each leader line is formed by it of it. Each terminal which constitutes the 2nd terminal array may attach an electrode pad in the end face of each leader line. It connects electrically, the 1st terminal array and the 2nd terminal array being positioned mutually, namely, between each terminal is connected electrically indirectly directly. If at least the 1st terminal array or the 2nd terminal array either has the terminal side which spread in the shape of a field, the tolerance of the locational error of the 1st terminal array and the 2nd terminal array is expandable.

[0013] Since according to this invention the member to which a signal is transmitted is connected linearly and leading about of wiring can be avoided, while being able to miniaturize a connection part, the problem of the cross talk between signals is also mitigable. Furthermore, since package connection of two terminal arrays can be made, compared with the case where a signal line is serially soldered to a target etc., the activity effort can be mitigated sharply, and, so, the manufacturing cost of an ultrasound probe can also be reduced sharply. Especially, the problem of the misdelivery-of-mail line at the time of connection of a signal line can fully be coped with. In addition, if connection of two terminal arrays is made using a conclusion member etc., there is an advantage that the part I material and the part II material are easily separable at the time of a maintenance.

[0014] Desirably, the anisotropy conductive member which has conductivity is prepared in perpendicularly [which it has insulation horizontally and intersects perpendicularly with an array side] the array side was met between said 1st terminal arrays and said 2nd terminal arrays. Here, an anisotropy conductive member may be an independent member and may be an ingredient with an adhesion operation to solidify.

[0015] Desirably, said anisotropy conductive member is an elastic body, and the conclusion member which carries out pressurization conclusion of said part I material and said part II material is prepared. According to this configuration, when concluding the part I material and the part II material, electrical installation positive about all terminals can be conjointly planned with an elastic operation of an anisotropy conductive member. Moreover, if a conclusion member is loosened, there is an advantage that the part I material and the part II material are easily separable at the time of a maintenance.

[0016] Desirably, the 1st electrode pad is formed in the end face of the inner conductor of each of said cable, and said 1st terminal array is constituted by them. Desirably, the 2nd electrode pad is formed in the end face of each of said leader line, and said 2nd terminal array is constituted by them.

[0017] the conductor which carries out alignment maintenance of the insulating section to which each of said cable has desirably the unreserved part of the internal insulator formed in the end face side over the predetermined range from the end face, and the unreserved part of the gland formed in the end face side over the predetermined range from the unreserved part of said internal insulator, and said part I material carries out alignment maintenance of the unreserved part of said internal insulator, and the unreserved part of said gland -- it has the section.

[0018] According to the above-mentioned configuration, each cable can be certainly held in the shape of an array. Especially, required insulating processing and electric conduction processing can be performed

to alignment maintenance and coincidence of a cable on the assumption that unreserved processing.
[0019] Desirably, said part I material has the locating plate with which two or more tooling holes in which the unreserved part of the internal insulator in said each cable is made to insert were formed further, and said insulating section is formed between the one direction of said locating plate, and the end face of each of said cable.
[0020] (2) In order to attain the above-mentioned purpose, moreover, the approach concerning this invention The process which performs gradual unreserved processing of an internal insulator and a gland for every cable about the multi-conductor cable which connotes two or more cables, The process which inserts the internal insulator of each of said cable, or the unreserved part of a gland in each tooling holes of the shape of an array formed in the 1st locating plate, The process of the end face of each of said cable to said 1st locating plate which, on the other hand, fills up the tip side space to a field with an insulating member, The process which forms the 1st terminal array corresponding to the end-face array of the inner conductor of each of said cable on the front face of said insulating member, The process which fills up the end face side space to the fixed range from the another side side of said 1st locating plate to a cable end face side with a conductive member, and connects the grand unreserved part of each cable mutually electrically, The process which forms the condition that two or more leader lines pulled out in the shape of an array from two or more piezoelectric devices were inserted in backing, and forms the 2nd terminal array corresponding to the end-face array of each of said leader line in the rear-face side of the backing, It is characterized by including the process connected mutually electrically, positioning said 1st terminal array and said 2nd terminal array.
[0021] Desirably, the fixture which encloses said tip side space and said end face side space is used at the time of restoration of said insulating member and said conductive member.
[0022] Desirably, it is filled up with backing presentation material and it is solidified so that said two or more leader lines may be laid under the rear-face side of two or more of said piezoelectric devices, and the condition that said two or more leader lines were inserted in backing by this is formed. Of course, two or more through tubes are formed and you may make it make a leader line insert in each through tube by machining of backing.
[0023] While inserting each leader line in each tooling holes formed in the 2nd locating plate desirably, restoration space is formed between said 2nd locating plate and said two or more piezoelectric devices, the restoration space is filled up with backing presentation material, it is solidified, and the condition that said two or more leader lines were inserted in backing by this is formed.
[0024] According to the above-mentioned configuration, two or more leader lines can be made to lay underground in backing by restoration solidification of backing presentation material. In restoration of backing presentation material, the same technique as restoration of the above-mentioned insulating member is applicable. For example, using the 1st locating plate of the above, and the 2nd locating plate with the same gestalt, each of those tooling holes may be made to penetrate a part of each leader line, on the other hand, restoration space may be formed using a fixture etc. between the field and two or more piezoelectric devices of the 2nd locating plate, the restoration space may be filled up with backing presentation material, and it may be solidified. In this case, a locating plate and backing presentation material consist of insulating members. Moreover, another restoration space is formed using a fixture etc. between the another side side of the 2nd locating plate, and the apical surface of each leader line, and you may make it filled up with an insulating member there. After the insulating member solidifies, the front face is ground and the 2nd terminal array is formed. In addition, it can be considered that the 2nd locating plate is a part of backing.
[0025] Desirably the process which forms said 1st terminal array The process at which grinding of the front face of said insulating member is carried out, and the end face of the inner conductor of each of said cable is exposed, The process which forms said 2nd terminal array including the process which is made to correspond to the end face of the inner conductor of each of said cable, and forms two or more electrode pads on the front face of the insulating member after said grinding The process which is made to correspond to the end face of each of said leader line, and forms two or more electrode pads on the rear face of said backing is included.

[0026] Desirably, mediation arrangement of the anisotropy conductive member is carried out between said 1st terminal arrays and said 2nd terminal arrays.
[0027] Desirably, the array of the tooling holes of said locating plate, the array of said 1st terminal array, the array of said 2nd terminal array, and the array of two or more of said leader lines are in agreement with the array of two or more of said piezoelectric devices.
[0028] Two or more effective components which actually perform the transmission-and-reception wave of a supersonic wave, and two or more other invalid components are desirably contained in said two or more vibrator, and the electric connection relation of said 1st terminal array and said 2nd terminal array is formed so that said two or more cables may be electrically connected only to said two or more effective components. That is, according to this configuration, sparse mold array vibrator can be constituted easily.
[0029]
[Embodiment of the Invention] Hereafter, the suitable operation gestalt of this invention is explained based on a drawing.
[0030] The suitable operation gestalt of the ultrasound probe concerning this invention is shown in drawing 1 and drawing 2 , drawing 1 is the perspective view showing the important section configuration of an ultrasound probe, and drawing 2 is the sectional view showing the important section configuration of an ultrasound probe.
[0031] In drawing 1 and drawing 2 , the connection unit 14 as part I material is formed in the multi-conductor cable 12, and the vibrator unit 10 is connected with the connection unit 14.
[0032] The vibrator unit 10 has two or more piezoelectric devices 16 arranged in the shape of [which performs the transmission-and-reception wave of a supersonic wave] a matrix. Electrode layer 16A is formed in the one direction of each piezoelectric device 16, and electrode layer 16B is formed in the another side side of a piezoelectric device 16. Two or more adjustment layers 20 are formed in the living body side of two or more piezoelectric devices 16 through the grand lead 18 which consists of copper foil etc. The adjustment layer 20 is a member for aiming at acoustic-impedance adjustment between a piezoelectric device 16 and a living body, and the adjustment layer 20 is formed every piezoelectric device 16.
[0033] The backing 22 which absorbs the unnecessary supersonic wave to back is formed in the tooth-back, i.e., non-living body, side of two or more piezoelectric devices 16. Two or more electrode layer 22A of the shape of an array corresponding to the array of each piezoelectric device 16 is formed in the living body side of backing 22, and two or more electrode pad (electrode layer) 22B is formed in the tooth-back, i.e., non-living body, side of backing 22 corresponding to the array array of the above. Here, the array of a piezoelectric device 16, the array of the adjustment layer 20, the array of electrode layer 22A, and the array of electrode pad 22B are the same respectively.
[0034] On the other hand, the connection unit 14 contains standing ways 36, the positioning frame 38, the electrode substrate 40, and two or more electrode pad 40A formed in the shape of an array so that the manufacture approach may be explained in full detail behind. Here, two or more electrode pad 40A constitutes the 1st terminal array, on the other hand, two or more electrode pad 22B mentioned above constitutes the 2nd terminal array, and those two terminal arrays are mutually connected electrically through the anisotropy conductive member 42 explained in full detail behind. This anisotropy conductive member 42 is a member which has conductivity in the direction perpendicular to an array side, and has insulation in the direction parallel to an array side on the other hand. For example, this comes to embed the gold streak of a large number penetrated perpendicularly in an elastic base material with insulation.
[0035] The multi-conductor cable 12 has two or more cables 32, the multicore frame gland 34 is established in the periphery enclosure of those cables 32, and the multi-conductor cable envelope 30 is further formed in the outside.
[0036] As a sectional view is shown in drawing 2 , each cable 32 consists of the cable inner conductor 50 formed on the medial axis, an interior insulator 48 of a cable which surrounds the cable inner conductor 50, a cable gland 46 which surrounds the interior insulator 48 of a cable, and a cable envelope

44 which wraps in the cable gland 46 further. As shown in drawing 2 , the cable gland 46 is removed from the end face of the end face 48 of a cable, i.e., the interior insulator of a cable, and the cable inner conductor 50 covering the fixed distance L1 by the side of a end face, namely, the interior insulator 48 of a cable is shown in the range. Moreover, the cable envelope 44 is removed from the location to the end face side covering the distance of L2, namely, the cable gland 46 is shown in the range. Moreover, the multicore frame gland 34 is removed from the location to the end face side covering distance L3, and the multi-conductor cable envelope 30 is removed to the location where only distance L4 retreated from the location to the end face side. That is, as a multi-conductor cable 12 is shown in drawing 2 , the edge shows gradually and is processed.

[0037] In drawing 2 , the positioning frame 38 consists of metals, such as stainless steel, and two or more insertion holes as a through tube are formed in the positioning frame 38. For example, such an insertion hole can be formed by etching processing. The unreserved part of the interior insulator 48 of a cable in each cable 32 is inserted in each insertion hole, and the electrode substrate 40 is formed in accordance with the amount of protrusions of the part projected from the positioning frame 38. It is filled up with insulating adhesives and this electrode substrate 40 becomes so that it may explain later. Moreover, a part of cable envelope 44 is incorporated, standing ways 36 are formed in the non-living body side of the positioning frame 38 with predetermined thickness, and the standing ways 36 come to fill up electroconductive glue. The insulating adhesives which constitute the electrode substrate 40 can use the thing of for example, an epoxy system here, and it is possible to use the thing of an epoxy system about the electroconductive glue which constitutes standing ways 36 as well as this.

[0038] Screw hole 22C as a through tube is formed also in the backing 22 which two or more screw hole 36A is formed in standing ways 36 as a through tube, and was mentioned above. In case the connection unit 14 is connected to the trembler unit 10, the shank of a screw 52 is inserted in those screw holes 36A and 22C, and a nut 54 is attached in the end side of the shank. That is, the vibrator unit 10 and the connection unit 14 are firmly connected with [of a screw 52 and a nut 54] a bundle, and the 2nd terminal array which specifically consists of two or more electrode pad 22B through the anisotropy conductive member 42, and the 1st terminal array which consists of two or more electrode pad 40A are connected electrically. Here, the anisotropy conductive member 42 has elasticity, can use such an elastic operation, and can ensure [stably and] electric connection between each electrode pad.

[0039] As shown in drawing 2 , corresponding to each piezoelectric device 16, two or more through tube 22D is formed in backing 22, and the leader line 56 is formed in the through tube 22D. It connects with electrode layer of leader line 56 with which edge was formed in living body side of backing 22 on the other hand 22A, and another side one end of a leader line 56 is connected to electrode pad 22B formed in the field by the side of the non-living body of backing 22. Incidentally, pressurization adhesion of the electrode layer 22A is carried out by electroconductive glue etc. at electrode layer 16B formed in the piezoelectric device 16.

[0040] The below-mentioned filling-up method for could mention various kinds of things as the technique of forming two or more leader lines 56 in this backing 22, for example, having used the positioning frame 38 etc. can be used. That is, an epoxy resin is used as a base material of backing 22, before an epoxy resin solidifies, a leader line 56 is embedded, an epoxy resin is stiffened after that, and it may be made to carry out alignment maintenance of the leader line 56.

[0041] As shown in drawing 2 , the both ends of the grand lead 18 enclose the periphery enclosure of the trembler unit 10 and the connection unit 14, and are pulled out at the end face side of a cable. And the grand lead 18 is electrically connected to the cable gland 46 of a cable 32 through the positioning frame 38 which had conductivity through the standing ways 36 with conductivity. That is, standing ways 36 have the function to connect electrically mutually the cable gland 46 which each cable 32 besides a fixed maintenance operation of each cable 32 has. Since the electrode substrate 40 has insulation even if such standing ways 36 and the positioning frame 38 incidentally have conductivity, the insulation between each cable inner conductor 50 or electrode pad 40A is maintained.

[0042] Next, the manufacture approach of an ultrasound probe shown in drawing 1 and drawing 2 using drawing 3 - drawing 7 is explained in full detail.

[0043] In drawing 3 , unreserved processing of the above edge is first made to a multi-conductor cable 12, and the interior insulator of cable unreserved part of each cable 32 is inserted in each insertion hole of the positioning frame 38 held with the fixture 60 after the unreserved processing. Here, a fixture 60 consists of frame 60A and bottom body 60B, and has the dished gestalt as these whole.
[0044] In the condition that insertion of the cable 32 to each insertion hole of the above positioning frames 38 was completed, the adhesives of the epoxy system of the specified quantity are slushed in the space across which it faces between the positioning frame 38 and bottom body 60B. When it solidifies, the electrode substrate 40 is constituted. However, in actual manufacture, grinding of the electrode substrate 40 is carried out by Mr. fixed Fukashi from the front face so that it may explain later. You may make it slush adhesives incidentally using the injected hole 61 formed in frame 60A in restoration of the above-mentioned adhesives. In that case, it is desirable to prepare an air vent etc. in a predetermined location.
[0045] Next, as shown in drawing 4 , the adhesives of an epoxy system which had conductivity the another side side side of a positioning frame and in the space surrounded by frame 60A are slushed. When it solidifies, standing ways 36 are constituted.
[0046] As mentioned above, these standing ways 36 have the function to connect electrically mutually the function to hold the array of each cable 32, and the cable gland 46.
[0047] Next, as shown in drawing 5 , a fixture 60 is removed and grinding processing is made ranging from on [to the fixed depth] a front face to the electrode substrate 40 after that. There is an advantage that the end face of the cable inner conductor 50 will be certainly exposed, and can ensure electric connection by such grinding processing. Incidentally, in the phase shown in drawing 5 , formation of screw hole 36A is performed to standing ways 36.
[0048] Next, as shown in drawing 6 , on the front face of the electrode substrate 40, it is made to correspond to the end face of each cable inner conductor 50, and two or more electrode pad 40A is formed. Nickel is made to adhere by electroless deposition processing on the front face of the electrode substrate 40, next a gold layer is made to specifically adhere by electrolytic plating processing on it first. Then, separation division of the generated electrode layer is carried out by dicing, and each electrode pad 40A is formed by this. Incidentally as the manufacture approach of electrode pad 40A, the thing using the spatter other than the above can be mentioned, and etching etc. may be used.
[0049] The front view of the electrode substrate 40 of having two or more electrode pad 40A formed as mentioned above is shown in drawing 7 . In this operation gestalt, although each part material has the outer diameter of an octagon, it is not restricted to such a gestalt, for example, you may have the circular outer diameter. Moreover, as shown in drawing 7 , four screw hole 36A is formed in the connection unit in this operation gestalt, it can bind tight to homogeneity over the whole perimeter of a terminal array, and an operation can be demonstrated.
[0050] As mentioned above, pressurization connection of them will be carried out by bolting operation of a screw 52 and a nut 54, mediation arrangement of the anisotropy conductive member 42 being carried out between the connection unit 14 and trembler unit 10, as shown in drawing 1 and drawing 2 , if the connection unit 14 is formed to a multi-conductor cable 12. In such the condition, the 1st terminal array which consists of two or more electrode pad 40A, and the 2nd terminal array which consists of two or more electrode pad 22B will be electrically connected for every terminal, respectively. Finally this enables it to connect electrically the inner conductor of the cable 32 corresponding to it to each piezoelectric device 16.
[0051] In the above configuration, in constituting the so-called sparse type of array vibrator, there is an advantage that a sparse mold configuration is easily realizable, by removing the terminal in one of terminal arrays. Moreover, if a predetermined signal is slushed into the cable 32 chosen as the end face side of a multi-conductor cable 12 and it observes the signal in corresponding electrode pad 40A in judging a quality respectively electric about formed electrode pad 40A in the manufacture of the connection unit 14 mentioned above, there is an advantage that the array location of the actuation and each cable can be checked easily.
[0052] In the above-mentioned operation gestalt, since it did not need to solder individually for each

signal line of every like before and the electrode pads 40A and 22B are used, there is an advantage of being easily maintainable. Moreover, since the array configuration is maintained from a multi-conductor cable 12 to two or more piezoelectric devices 16, while the problem of a cross talk is mitigable, since it can wire to the minimum volume, there is an advantage that the gestalt of an ultrasound probe can be miniaturized. Although especially the technique concerning this invention has more large effectiveness, when, manufacturing 1D array vibrator, 1.5D array vibrator, etc., of course in manufacture of the ultrasound probe which has 2D array vibrator, it can acquire effectiveness.

[0053] Although there is an advantage that positioning of the height direction is easy, with the operation gestalt shown in drawing 2 etc. since the positioning frame 38 was formed in the upper limit (location which contacts the end face of the unreserved part of the cable gland 46) of the unreserved part of the interior insulator 48 of a cable, the positioning frame 38 may be formed in the other location if needed. For example, the positioning frame 38 is formed in the unreserved part of the cable gland 46, the end face side space 100 is filled up with a conductive member, and you may make it fill up the tip side space 102 with an insulating member, as shown in drawing 8 R> 8. In addition, the sign 104 shows the top face of the bottom plate as some fixtures. When shown in drawing 8 , in order to connect the cable gland of each cable electrically by the conductive member, as sign 46A shows, it is necessary to make it partially exposed [the unreserved part of the cable gland 46] from the positioning frame 38 bottom.

[0054] Moreover, you may make it prepare in the location which pulled down the positioning frame 38 to the top-face 104 side on the unreserved part of the interior insulator 48 of a cable, as shown in drawing 9 . Also in this case, the end face side space 100 is filled up with a conductive member, and the tip side space 102 is filled up with an insulating member. Furthermore, it is processed by showing also about the cable inner conductor 50, for example, the positioning frame 38 is formed on the unreserved part of the interior insulator 48 of a cable, the end face side space 100 is filled up with a conductive member, and you may make it fill up the tip side space 102 with an insulating member, as shown in drawing 10 . Anyway, each cable is held certainly, and as long as the function of each part material is demonstrated effectively, various kinds of modes can be adopted.

[0055] In addition, in constituting a sparse mold array trembler, it sets up the electric connection relation between the 1st terminal array and the 2nd terminal array so that two or more cables may be electrically connected only to two or more effective components contained in it. namely, -- for example, -- usually -- a passage -- 2D array vibrator -- forming -- although -- except for an effective component -- if electrode pad 22B (refer to drawing 2) is individually removed about an invalid component or it is made not to form electrode pad 22B, a de facto invalid component can be formed as a result. Of course, the same operation can be acquired even if it removes other signal transduction members, such as electrode pad 22A and a leader line 56.

[0056]

[Effect of the Invention] As explained above, according to this invention, electric connection between an array trembler and a cable group can be ensured [simple and]. Moreover, while the manufacturing cost of an ultrasound probe is reducible according to this invention, there is an advantage that the operational reliability of an ultrasound probe can be improved.

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] Are the member which carries out alignment maintenance of the cable group into which the edge showed and was processed at the shape of an array, and while interconnecting electrically, the gland of each cable The part I material which forms the 1st terminal array as an end-face array of the inner conductor of each cable, The part II material which is a member which carries out alignment maintenance of the leader line group pulled out from two or more piezoelectric devices at the shape of an array, and forms the 2nd terminal array as an end-face array of each leader line, The ultrasound probe characterized by including the connecting means connected mutually electrically, positioning said 1st terminal array and said 2nd terminal array.
[Claim 2] The ultrasound probe characterized by preparing the anisotropy conductive member which has conductivity in an ultrasound probe according to claim 1 in perpendicularly [which it has insulation horizontally and intersects perpendicularly with an array side] the array side met between said 1st terminal arrays and said 2nd terminal arrays.
[Claim 3] It is the ultrasound probe characterized by preparing the conclusion member which said anisotropy conductive member is an elastic body in an ultrasound probe according to claim 2, and carries out pressurization conclusion of said part I material and said part II material.
[Claim 4] The ultrasound probe characterized by having formed the 1st electrode pad in the end face of the inner conductor of each of said cable, and said 1st terminal array being constituted by them in an ultrasound probe according to claim 1.
[Claim 5] The ultrasound probe characterized by having formed the 2nd electrode pad in the end face of each of said leader line, and said 2nd terminal array being constituted by them in an ultrasound probe according to claim 1.
[Claim 6] In an ultrasound probe according to claim 1 said each cable The unreserved part of the internal insulator formed in the end face side over the predetermined range from the end face, It has the unreserved part of the gland formed in the end face side over the predetermined range from the unreserved part of said internal insulator. Said part I material the conductor which carries out alignment maintenance of the insulating section which carries out alignment maintenance of the unreserved part of said internal insulator, and the unreserved part of said gland -- the ultrasound probe characterized by having the section.
[Claim 7] Said part I material is an ultrasound probe which has the locating plate with which two or more tooling holes in which the unreserved part of an internal insulator [in / further / on an ultrasound probe according to claim 6 and / said each cable] is made to insert were formed, and is characterized by the thing of said locating plate for which said insulating section was formed between the field and the end face of each of said cable on the other hand.
[Claim 8] The process which performs gradual unreserved processing of an internal insulator and a gland for every cable about the multi-conductor cable which connotes two or more cables, The process which inserts the internal insulator of each of said cable, or the unreserved part of a gland in each tooling holes of the shape of an array formed in the 1st locating plate, The process of the end face of each of

said cable to said 1st locating plate which, on the other hand, fills up the tip side space to a field with an insulating member, The process which forms the 1st terminal array corresponding to the end-face array of the inner conductor of each of said cable on the front face of said insulating member, The process which fills up the end face side space to the fixed range from the another side side of said 1st locating plate to a cable end face side with a conductive member, and connects the grand unreserved part of each cable mutually electrically, The process which forms the condition that two or more leader lines pulled out in the shape of an array from two or more piezoelectric devices were inserted in backing, and forms the 2nd terminal array corresponding to the end-face array of each of said leader line in the rear-face side of the backing, The manufacture approach of the ultrasound probe characterized by including the process connected mutually electrically, positioning said 1st terminal array and said 2nd terminal array.
[Claim 9] The manufacture approach of the ultrasound probe characterized by using the fixture which encloses said tip side space and said end face side space at the time of restoration of said insulating member and said conductive member in an approach according to claim 8.
[Claim 10] The manufacture approach of the ultrasound probe characterized by forming the condition that it was filled up with backing presentation material and solidified it in the approach according to claim 8 so that said two or more leader lines might be laid under the rear-face side of two or more of said piezoelectric devices, and said two or more leader lines were inserted in backing by this.
[Claim 11] The manufacture approach of the ultrasound probe characterized by forming the condition which inserts each leader line in each tooling holes formed in the 2nd locating plate in an approach according to claim 8 that formed restoration space between said 2nd locating plate and said two or more piezoelectric devices, both filled up the restoration space with backing presentation material, solidified it, and said two or more leader lines were inserted in backing by this.
[Claim 12] In an approach according to claim 8, the process which forms said 1st terminal array The process at which grinding of the front face of said insulating member is carried out, and the end face of the inner conductor of each of said cable is exposed, The process which forms said 2nd terminal array including the process which is made to correspond to the end face of the inner conductor of each of said cable, and forms two or more electrode pads on the front face of the insulating member after said grinding The manufacture approach of the ultrasound probe characterized by including the process which is made to correspond to the end face of each of said leader line, and forms two or more electrode pads on the rear face of said backing.
[Claim 13] The manufacture approach of the ultrasound probe characterized by carrying out mediation arrangement of the anisotropy conductive member between said 1st terminal arrays and said 2nd terminal arrays in an approach according to claim 8.
[Claim 14] It is the manufacture approach of the ultrasound probe characterized by the array of the tooling holes of said 1st locating plate, the array of said 1st terminal array, the array of said 2nd terminal array, and the array of two or more of said leader lines being in agreement with the array of two or more of said piezoelectric devices in an approach according to claim 8.
[Claim 15] The manufacture approach of the ultrasound probe characterized by forming the electric connection relation of said 1st terminal array and said 2nd terminal array so that two or more effective components which actually perform the transmission-and-reception wave of a supersonic wave, and two or more other invalid components may be contained in said two or more vibrator in an approach according to claim 8 and said two or more cables may be electrically connected only to said two or more effective components.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] Especially this invention relates to the connection structure of a cable about an ultrasound probe and its manufacture approach.

[Translation done.]

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PRIOR ART

[Description of the Prior Art] 2-dimensional array vibrator (2D vibrator) consists of two or more oscillating components by which the two-dimensional array was carried out. Such a 2-dimensional array trembler is used, when scanning a 2-dimensional ultrasonic beam and incorporating three-dimensions echo data. As other array vibrator, 1D array vibrator, 1.5D array vibrator, etc. are known.
[0003] In the conventional general manufacture approach, when it interconnects the leader line group pulled out from a 2-dimensional array trembler, and the cable group which constitutes a multi-conductor cable, the flexible circuit board (FPC) under which the leader line group crowded in and was laid is used, and the inner conductor of each cable by which terminal treatment was carried out to each electrode on the flexible circuit board is soldered directly. Or one connector on the flexible circuit board and the connector of another side where the inner conductor of each cable was soldered are connected.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to this invention, electric connection between an array trembler and a cable group can be ensured [simple and]. Moreover, while the manufacturing cost of an ultrasound probe is reducible according to this invention, there is an advantage that the operational reliability of an ultrasound probe can be improved.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Therefore, in the former, it surely becomes easy to produce an electric cross talk at a flexible time on the street or a cable splicing point, and there is a problem that this reduces image quality. Moreover, since it is generally super-thin, prudent handling is called for, and each cable requires an effort great for the terminal treatment (soldering) of hundreds of cables especially. Consequently, there is a problem that a manufacturing cost increases. Furthermore, in such a production process, it will be necessary to perform the check of a misdelivery-of-mail line etc. Moreover, the structure of an ultrasound probe becomes complicated for the existence of such a connection part and the flexible circuit board, and it becomes the hindrance of the miniaturization.
[0005] Especially the above-mentioned problem becomes more remarkable, as an element number increases. Of course, in connection with increase of an element number, the above-mentioned problem is remarkable also about array vibrator other than 2D array vibrator.
[0006] This invention is made in view of the above-mentioned conventional technical problem, and the purpose enables it to perform electrical installation of an array trembler and a cable group simple and certainly.
[0007] Other purposes of this invention are to reduce the manufacturing cost of an ultrasound probe.
[0008] Other purposes of this invention are shown in attaining the miniaturization of an ultrasound probe.
[0009] Other purposes of this invention are to raise the operational reliability of an ultrasound probe.

[Translation done.]

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MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose, (1) This invention Are the member which carries out alignment maintenance of the cable group into which the edge showed and was processed at the shape of an array, and while interconnecting electrically, the gland of each cable The part I material which forms the 1st terminal array as an end-face array of the inner conductor of each cable, The part II material which is a member which carries out alignment maintenance of the leader line group pulled out from two or more piezoelectric devices at the shape of an array, and forms the 2nd terminal array as an end-face array of each leader line, It is characterized by including the connecting means connected mutually electrically, positioning said 1st terminal array and said 2nd terminal array.
[0011] According to the above-mentioned configuration, alignment maintenance of each cable (desirably coaxial cable) is carried out by the part I material, and the gland of each cable is mutually connected electrically in that case. Moreover, the 1st terminal array corresponding to the end-face array of the inner conductor of each cable is formed of such alignment maintenance of each cable. Here, although each terminal which constitutes the 1st terminal array may be the ground end face of the inner conductor of each cable itself, it may attach an electrode pad in such an end face.
[0012] On the other hand, alignment maintenance of each leader line is carried out by the part II material, and the 2nd terminal array corresponding to the end-face array of each leader line is formed by it of it. Each terminal which constitutes the 2nd terminal array may attach an electrode pad in the end face of each leader line. It connects electrically, the 1st terminal array and the 2nd terminal array being positioned mutually, namely, between each terminal is connected electrically indirectly directly. If either [at least] the 1st terminal array or the 2nd terminal array has the terminal side which spread in the shape of a field, the tolerance of the locational error of the 1st terminal array and the 2nd terminal array is expandable.
[0013] Since according to this invention the member to which a signal is transmitted is connected linearly and leading about of wiring can be avoided, while being able to miniaturize a connection part, the problem of the cross talk between signals is also mitigable. Furthermore, since package connection of two terminal arrays can be made, compared with the case where a signal line is serially soldered to a target etc., the activity effort can be mitigated sharply, and, so, the manufacturing cost of an ultrasound probe can also be reduced sharply. Especially, the problem of the misdelivery-of-mail line at the time of connection of a signal line can fully be coped with. In addition, if connection of two terminal arrays is made using a conclusion member etc., there is an advantage that the part I material and the part II material are easily separable at the time of a maintenance.
[0014] Desirably, the anisotropy conductive member which has conductivity is prepared in perpendicularly [which it has insulation horizontally and intersects perpendicularly with an array side] the array side was met between said 1st terminal arrays and said 2nd terminal arrays. Here, an anisotropy conductive member may be an independent member and may be an ingredient with an adhesion operation to solidify.
[0015] Desirably, said anisotropy conductive member is an elastic body, and the conclusion member

which carries out pressurization conclusion of said part I material and said part II material is prepared. According to this configuration, when concluding the part I material and the part II material, electrical installation positive about all terminals can be conjointly planned with an elastic operation of an anisotropy conductive member. Moreover, if a conclusion member is loosened, there is an advantage that the part I material and the part II material are easily separable at the time of a maintenance.
[0016] Desirably, the 1st electrode pad is formed in the end face of the inner conductor of each of said cable, and said 1st terminal array is constituted by them. Desirably, the 2nd electrode pad is formed in the end face of each of said leader line, and said 2nd terminal array is constituted by them.
[0017] the conductor which carries out alignment maintenance of the insulating section to which each of said cable has desirably the unreserved part of the internal insulator formed in the end face side over the predetermined range from the end face, and the unreserved part of the gland formed in the end face side over the predetermined range from the unreserved part of said internal insulator, and said part I material carries out alignment maintenance of the unreserved part of said internal insulator, and the unreserved part of said gland -- it has the section.
[0018] According to the above-mentioned configuration, each cable can be certainly held in the shape of an array. Especially, required insulating processing and electric conduction processing can be performed to alignment maintenance and coincidence of a cable on the assumption that unreserved processing.
[0019] Desirably, said part I material has the locating plate with which two or more tooling holes in which the unreserved part of the internal insulator in said each cable is made to insert were formed further, and said insulating section is formed between the one direction of said locating plate, and the end face of each of said cable.
[0020] (2) In order to attain the above-mentioned purpose, moreover, the approach concerning this invention The process which performs gradual unreserved processing of an internal insulator and a gland for every cable about the multi-conductor cable which connotes two or more cables, The process which inserts the internal insulator of each of said cable, or the unreserved part of a gland in each tooling holes of the shape of an array formed in the 1st locating plate, The process of the end face of each of said cable to said 1st locating plate which, on the other hand, fills up the tip side space to a field with an insulating member, The process which forms the 1st terminal array corresponding to the end-face array of the inner conductor of each of said cable on the front face of said insulating member, The process which fills up the end face side space to the fixed range from the another side side of said 1st locating plate to a cable end face side with a conductive member, and connects the grand unreserved part of each cable mutually electrically, The process which forms the condition that two or more leader lines pulled out in the shape of an array from two or more piezoelectric devices were inserted in backing, and forms the 2nd terminal array corresponding to the end-face array of each of said leader line in the rear-face side of the backing, It is characterized by including the process connected mutually electrically, positioning said 1st terminal array and said 2nd terminal array.
[0021] Desirably, the fixture which encloses said tip side space and said end face side space is used at the time of restoration of said insulating member and said conductive member.
[0022] Desirably, it is filled up with backing presentation material and it is solidified so that said two or more leader lines may be laid under the rear-face side of two or more of said piezoelectric devices, and the condition that said two or more leader lines were inserted in backing by this is formed. Of course, two or more through tubes are formed and you may make it make a leader line insert in each through tube by machining of backing.
[0023] While inserting each leader line in each tooling holes formed in the 2nd locating plate desirably, restoration space is formed between said 2nd locating plate and said two or more piezoelectric devices, the restoration space is filled up with backing presentation material, it is solidified, and the condition that said two or more leader lines were inserted in backing by this is formed.
[0024] According to the above-mentioned configuration, two or more leader lines can be made to lay underground in backing by restoration solidification of backing presentation material. In restoration of backing presentation material, the same technique as restoration of the above-mentioned insulating member is applicable.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view showing the important section configuration of the ultrasound probe concerning this invention.
[Drawing 2] It is the sectional view showing the important section configuration of the ultrasound probe concerning this invention.
[Drawing 3] It is drawing for explaining the manufacture approach of the ultrasound probe concerning this invention.
[Drawing 4] It is drawing for explaining the manufacture approach of the ultrasound probe concerning this invention.
[Drawing 5] It is drawing for explaining the manufacture approach of the ultrasound probe concerning this invention.
[Drawing 6] It is drawing for explaining the manufacture approach of the ultrasound probe concerning this invention.
[Drawing 7] It is drawing showing two or more electrode pads formed in the shape of a matrix.
[Drawing 8] It is drawing showing the relation of the cable and locating plate with which gradual draw processing was made.
[Drawing 9] It is drawing showing the relation of the cable and locating plate with which gradual draw processing was made.
[Drawing 10] It is drawing showing the relation of the cable and locating plate with which gradual draw processing was made.
[Description of Notations]
10 Trembler Unit, 12 Multi-conductor Cable, 14 Connection Unit (Part I Material), 16 A piezoelectric device, 18 A grand lead, 20 An adjustment layer, 22 Backing (part II material), 30 A multi-conductor cable envelope, 32 A cable, 34 Multicore frame gland, 36 Standing ways, 38 A positioning frame, 40 An electrode substrate, 42 An anisotropy conductive member, 44 A cable envelope, 46 A cable gland, 48 The interior insulator of a cable, 50 A cable inner conductor, 52 A screw, 54 A nut, 56 A leader line, 60 Fixture.

[Translation done.]

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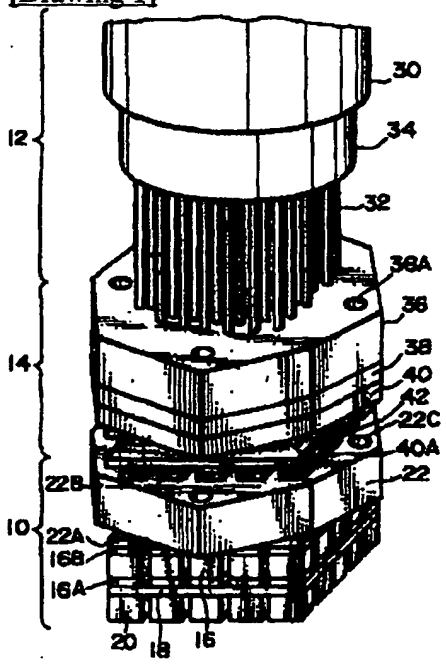
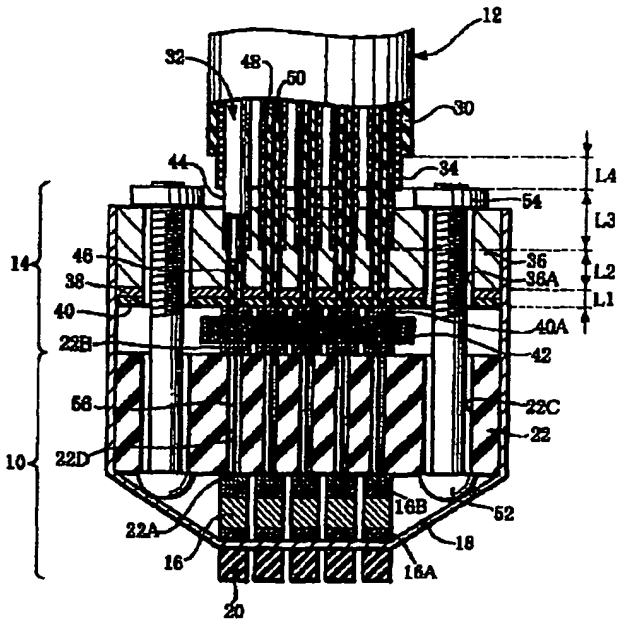
DRAWINGS

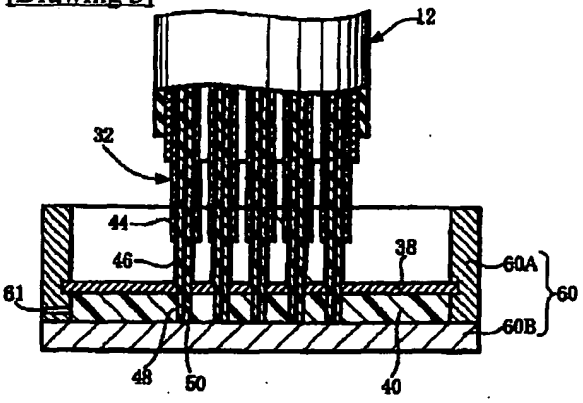
[Drawing 1]



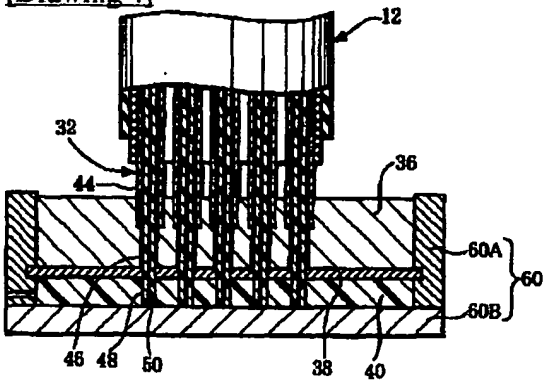
[Drawing 2]



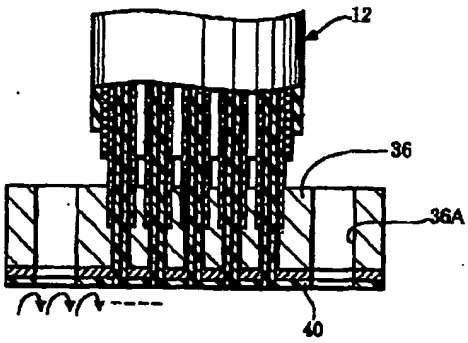
[Drawing 3]



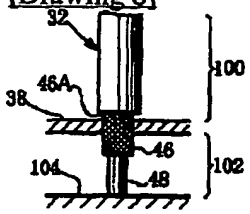
[Drawing 4]



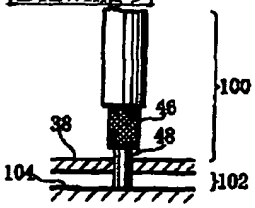
[Drawing 5]



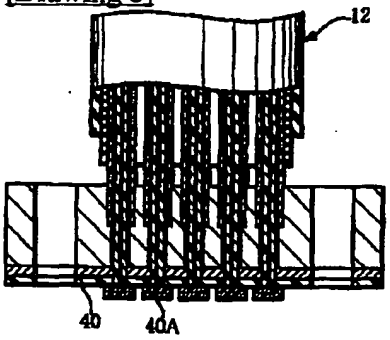
[Drawing 8]



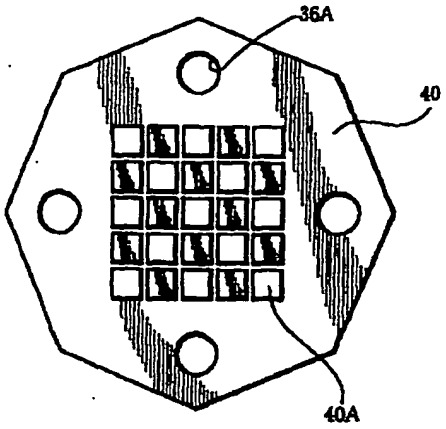
[Drawing 9]



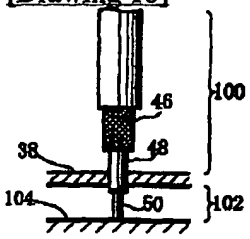
[Drawing 6]



[Drawing 7]



[Drawing 10]



[Translation done.]